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PROBING THE METHODOLOGY AND INTERPRETATION OF LEARNED CATEGORICAL PERCEPTION RESEARCH

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INTRODUCTION

What is learned CP?

Learned categorical perception (CP) occurs when the perceived similarity of a set of items depends at least in part on their categorization. Learned CP manifests as either members of different categories becoming less similar (expansion) and/or members of the same category becoming more similar (compression) as a result of category learning. Despite these effects being widely demonstrated, past studies exhibit low statistical power and the literature lacks a unifying theoretical framework.

Our Goal

We seek to conduct a systematic methodological critique of learned CP in order to clarify the theoretical and practical implications of the phenomenon. This process involves the topic of our work this summer: replicating the effect under the conditions with which it has traditionally been reported. This study will serve as a foundation for conducting a series of experiments systematically varying methodological choices to investigate how these choices impact the presence of the effect.

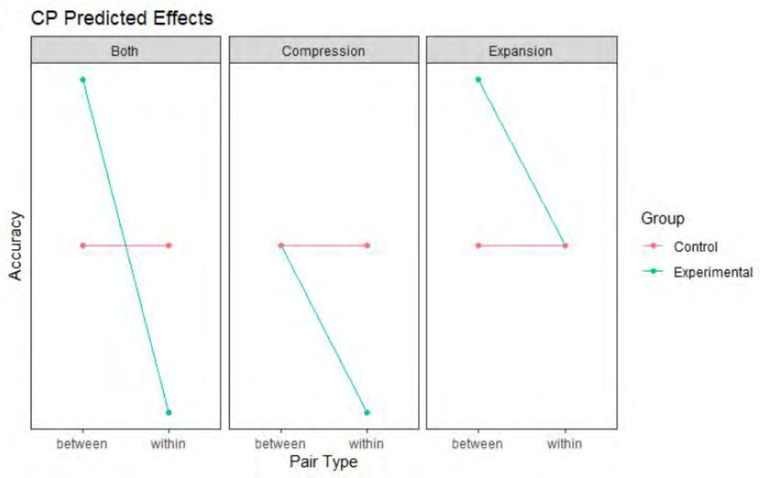


Figure 3 The three potential patterns of learned CP effects: compression (members of the same category appear more similar), expansion (members of different categories appear more different), or both.

RESULTS & DISCUSSION

Our replication did not produce any learned CP effects. Figure 3 (above) and figure 4 (right) show possible CP patterns contrasted with the observed patterns in our data. Bayesian regression models did not show any significant interaction between experimental condition and XAB performance and pairwise Bayes factor comparisons between groups on each pair type favored the null hypothesis of no effect in every case. Possible explanations for our null results include the fact that our stimuli featured only four values along each dimension and were highly discriminable at ~80% accuracy, which could have made the task too easy for participants to show significant improvement. Our stimuli also incorporated random variation in the placement of dots and lines, making them more reflective of the natural world but different from prior work.

METHOD

Our stimuli, called "sunbursts," are composed of two dimensions: quantity of dots and lines (see Figure 1). These stimuli are divided into two novel categories either along the vertical dotted line (dot-dependent categories) or the horizontal dotted line (line-dependent categories). Participants in the experimental groups are trained to classify stimuli according to either the dot or line dimension, while the control group receives no category training. The performance of these groups on a subsequent XAB task, in which participants are asked to choose from among two options which is most similar to a previously shown stimulus (see Figure 2), is compared in order to independently investigate learned CP effects for either of these two dimensions. Our stimulus space is controlled so that adjacent pairs of sunbursts along each dimension are discriminable with approximately 80% accuracy prior to learning. This allows participants to demonstrate either improved or worsened performance at discriminating pairs.

An important deviation of our stimuli from past work is that, while each of the four values along either dimension corresponds to a fixed quantity of dots or lines, the precise location of the dots and lines randomly varies each time a stimulus is shown. We include this feature to mimic the natural variation found in real-world categories.

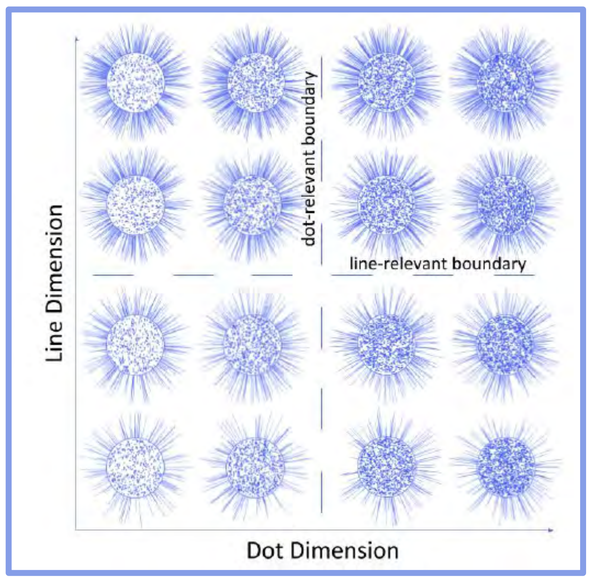
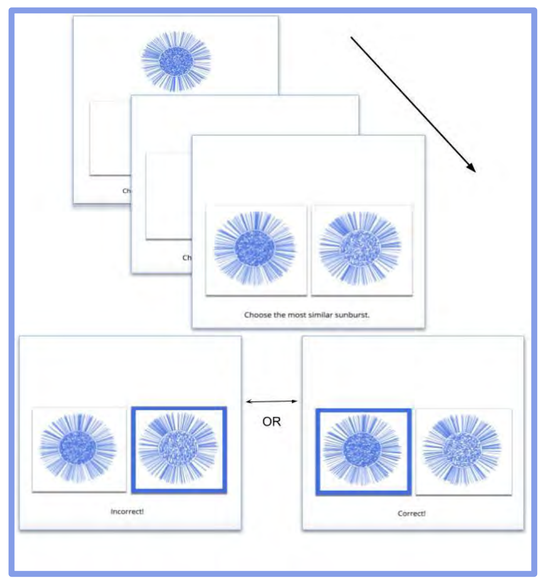


Figure 1 (left) The 4 x 4 stimulus matrix used in our replication. These stimuli, called "sunbursts," differ on the number of dots and lines. The space can be divided into two novel categories defined by one of the two dimensions, shown by the horizontal and vertical lines, respectively.

Figure 2 (right) The procedural sequence in a single XAB trial. This pair of stimuli differs on the number of dots.



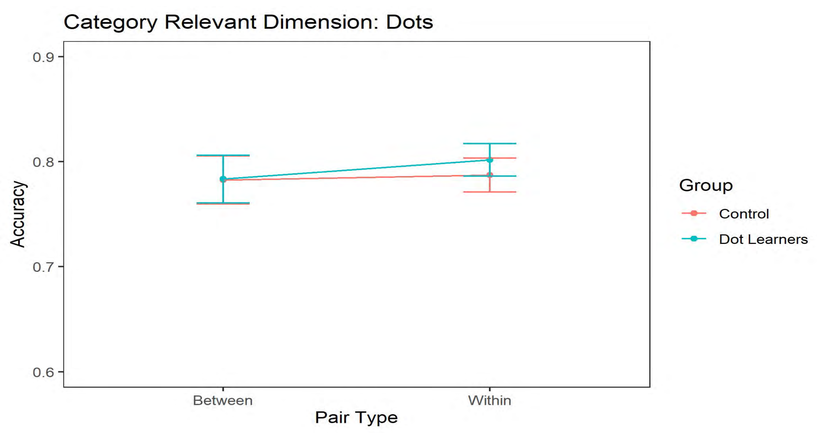
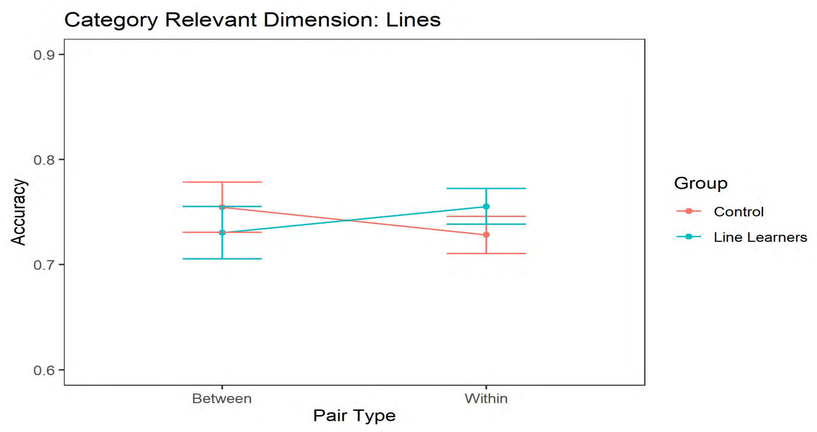


Figure 4 There was no significant difference between the control and experimental groups, and nothing similar to the expected learned CP patterns for either dot learners (above) or line learners (below).



FOLLOW UP & FUTURE WORK

We conducted a follow-up experiment that increased the amount of values along each dimension to six and lowered the pre-learning discriminability of adjacent stimuli to ~60% in order to explore the influence of these features, and we are in the process of analyzing this data.

Upcoming experiments will continue our project's initiative of systematically documenting the impact of methodological choices on learned CP. Our failed replication reported here has directed our attention towards exploring the importance of stimulus and category structure, because stimulus choice, and as a consequence category structure, was the primary deviation from prior literature in our otherwise procedurally-similar replication. The wide diversity of stimuli used in learned CP research justified our use of unique stimuli. However, our initial non-replication demands that we examine this component rigorously in our subsequent work.